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(54) Title: A PARTICULATE MINERAL SALT COMPOSITION AND A PROCESS FOR PRODUCING THE SAME

(57) Abstract

A mineral salt composition consists of particles having a core and at least one coating or surface layer, the composition of the core being 35-65 % sodium chloride, 5-40 % potassium chloride, 5-35 % magnesium salts and if desired also 0.1-1 % essential trace metal salts, and the composition of at least one coating or surface layer being 35-100 % sodium chloride and 65-0 % potassium chloride. The particles may further be coated with a non-hygroscopic substance, such as sodium alginate, polyethylene glycol, carboxymethylcellulose or methylcellulose. The particles are preferably spherical and may have a particle size of 50-1000 µm, preferably 100-500 µm and more preferably 150-300 µm. The mineral salt composition is produced by spray drying a solution of mineral salts having the composition of the core and subsequently coating the particles obtained, in a manner known per se, with a solution of sodium chloride or a mixture of sodium chloride and potassium chloride. The composition is useful as a table or household salt.

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A PARTICULATE MINERAL SALT COMPOSITION AND A PROCESS FOR PRODUCING THE SAME

The invention relates to a particulate mineral salt composition, comprising particles containing sodium chloride, potassium chloride, magnesium salts and a broad spectrum of other mineral salts, including trace elements, in physiologically acceptable amounts and proportions.

The invention further relates to a process for producing the mineral salt composition.

Pure sodium chloride is extensively used as a table salt for seasoning and as an additive for preserving food. Sodium chloride is an important mineral which is essential for the animal and human organism. Thus, the electrolyte balance in the animal and human tissue is determined by the relative concentration af sodium chloride, potassium chloride and magnesium salts.

An adult human normally loses 1 - 4 g salt daily in sweat and through the kidneys. Compensation for this loss may be supplied with the food and drinking. Many people consume a larger amount of salt than needed for covering their natural requirement, however. It is not unusual that a person, eating salted food, consumes 10 - 25 g sodium chloride each day. The surplus will be secreted, primarily via the kidneys. As the organism is not able to secrete pure sodium chloride, many other minerals, including the trace elements which are important for several enzyme reactions, will simultaneously be secreted. The result can be various deficiency diseases, such as heartbeat or other circulatory disturbances and many other chronical diseases. Even cancer is suspected to be correlated with an incorrect salt balance.

The problem is not merely solved by using mineral salt

additives, as intake of some minerals in too high concentrations may expel other essential elements.

For this reason, low sodium compositions have been proposed as salt substitutes. For example, from GB 2 015 863 is known a salt composition consisting of 50 - 65 % sodium chloride, 20 - 40 % potassium chloride and 5 - 20 % magnesium salts as chloride and/or sulfate. This composition is devoid of trace minerals and is thus not able to compensate for loss of such minerals. Also, the taste is different from pure sodium chloride. In particular, the content of magnesium salts will give the preparation a bitter taste and also impart a certain hygroscopicity.

From FR 1 583 412 it is known to fractionate sea water into separate fractions, the first of which consist of pure sodium chloride, while magnesium and potassium salts and the essential elements will accumulate in the subsequent fractions.

EP-B1-0 221 096 relates to a mineral salt composition, comprising a dry homogeneous particulate or granulated mixture of soluble mineral salts, evenly distributed as a homogenous mixture and containing the mineral salts in substantially the same relative proportions as in sea water, except for a reduced content of sodium chloride. This salt is physiologically highly acceptable as it contains all the electrolytes and trace elements in proportions corresponding very well to the composition of the body fluids. If a surplus of this salt is taken, it will be secreted in almost the same proportions as consumed and no mineral deficiency will result.

When using said known composition as a table salt, the organism is thus compensated for possible loss of trace elements by secretion. As the salt mixture has a rather high content of magnesium salts, it will have a distinct

bitter taste which may be unpleasant, however. The product is also more or less hygroscopic as it contains various hygroscopic salts.

EP-A2-0 130 821, EP-A1-0 130 822 and EP-A1-0 228 325 disclose a salt substitute containing potassium chloride particles coated with maltodextrin and a process for producing such particles. This known process comprises spraying an aqueous solution containing maltodextrin onto an agitated and heated bed of particles including potassium chloride. The coating may also contain sodium chloride, cream of tartar, or a mixture thereof. Said salt composition is proposed as a substitute for common table salt and the purpose has been to improve taste and appearance of the product.

An object of the present invention is to provide a physiologically acceptable table salt containing all essential minerals in optimal proportions as required by the organism and corresponding to the natural composition of the body fluids.

Another object of the invention is to produce a salt composition having the same taste as common table salt.

Still another object of the invention is to overcome the drawbacks of the salt composition described in EP 0 221 096 as to bitter taste and hygroscopicity.

These and other objects as explained in the following are obtained according to the present invention as defined in the claims. The mineral salt composition according to the invention is particulate and contains sodium chloride, potassium chloride, magnesium salts and a broad spectrum of other mineral salts, including trace elements, in physiologically acctptable amounts and proportions. The improved taste and reduced hygroscopicity are obtained by

a specific distribution of the mineral salt components in each particle, so that the hygroscopic and bitter tasting components are preferably concentrated in the core of each particle.

The mineral salt composition of the invention is thus characterized in that each or a major part of said particles consists of a core having one or more coatings, the magnesium salts and trace elements being primarily concentrated in the core and at least one of the coatings having a high content of sodium chloride or consists of a mixture of sodium chloride and potassium chloride, preferably devoid of magnesium salts.

Thus, an outer or surface layer of each particle consists primarily of pure sodium chloride or a mixture of sodium chloride and potassium chloride. Both these salts are non-hygroscopic and give the product a taste almost identical to pure sodium chloride. A high content of potassium chloride in the surface layer will even enhance the salty taste.

A further reduction of the hygroscopicity may be obtained, in accordance with invention, if each particle is covered with one or more non-hygroscopic or water repellent substances. Examples of such substances are sodium alginate, polyethylene glycol, carboxymethylcellulose, methylcellulose and similar.

The mineral salt composition of the invention may be produced by a process wherein a first solution containing sodium chloride, potassium chloride, magnesium salts and a broad spectrum of other mineral salts, including trace elements, in physiologically acceptable amounts and proportions, is spray dried, whereafter the particles obtained are coated, in a manner known per se, with a second solution containing sodium chloride or a mixture of sodium chloride

and potassium chloride. In such a manner is obtained a freely flowing non-hygroscopic mineral salt composition having substantially the same salty taste as common salt.

During the process, the core particles may be encapsulated with a high molecular film forming coating, such as sodium alginate, polyethylene glycol, carboxymethylcellulose, methylcellulose or a similar organic polymer, and subsequently coated with sodium chloride or a mixture of sodium chloride and potassium chloride. The bitter taste of magnesium salts and other mineral salts in the core will thereby be eliminated while the advantageous physiological properties are maintained.

If desired, various spices or flavouring substances may be incorporated in one or several coatings on the cores, preferably in small amounts. Examples of such substances are pebber, ginger, vanillin, monosodium glutamate, citric acid, garlic, or fruit juices.

The invention is illustrated in the following by means of a number of non-limiting examples wherein all parts and percentages are based on weight.

Example 1

Ocean water having a content of about 35 g mineral salts per litre is filtered and evaporated to form a concentrated solution. This solution is then spray dried in a conventional spray drying apparatus. The particles formed are coated in a conventional manner in a fluid bed with a diluted solution of sodium chloride. The initial taste of the product is identical to common table salt. A slightly bitter after-taste is perceptible, however, but not so pronounced as the taste of the core particles without coating. The product is a non-hygroscopic non-lumpy particulate proparation at room temperature and under

normal conditions.

Example 2

The process of example 1 is repeated with the modification that a solution of 65 % sodium chloride and 35 % potassium chloride is used as the coating solution. The preparation has almost the same salty taste and the same physical properties as the product produced according to example 1.

Example 3

The process of example 1 is repeated with the modification that a solution of 40 % sodium chloride and 60 % potassium chloride is used as the coating solution. The preparation has a more distinct salty taste than the product produced according to example 1.

Example 4

Ocean water containing about 35 g mineral salts per litre is evaporated to 1/15 of the original volume. About 10 g of sodium chloride is precipitated and removed by filtration. A saturated solution of potassium chloride is added to the mother liquid in such an amount that the total content of potassium chloride in the final solution is the same as the content of sodium chloride, based on weight. The solution is spray dried and further coated with a solution of sodium chloride and potassium chloride in equal amounts. The taste of the product is slightly more "salty" than common table salt. The particulate product is stable and not hygroscopic at room temperature under normal humid conditions.

Example 5

The method of example 3 is repeated, exept that the particles are further coated with a 0,5 % solution of sodium alginate. This product is stable and non-hygroscopic for a long period, also in humid air.

Example 6

500 litre ocean water containing 35 g mineral salts per litre is mixed with 500 litre "Geobrine", produced by Reykjanes Geo-Chemicals Ltd, Iceland. The "Geobrine" is obtained by drilling in the vulcanoic soil at Reykjanes, Iceland, and has the following composition:

	g/litre
Cl	29,8
Ca	2,56
Mg	0
Na	15,3
K	2,13
Br	0,1
Trace minerals ..... less than	0,5

The mixture, containing about 43 g mineral salts per litre, is evaporated until 10 g crystalline sodium chloride is precipitated, and the isolated mother liquid is spray dried to form core particles. These are very hygroscopic due to the high content of calcium chloride.

The separated crystalline sodium chloride is dissolved in water to form a 10 % solution which is used to coat the particles formed as described above. The coating procedure is performed in fluid bed in a conventional manner.

Then, the particles coated with sodium chloride is further coated with a 0,5 % solution of polyethylene glycol, using

a conventional fluid bed coating apparatus.

The resulting product has a particle size of about 150 µm and is stable and non-hygroscopic at room temperature and normal humid conditions.

Example 7

Example 6 is repeated with the modification that the cores are coated with a first layer of equal amounts of sodium chloride and potassium chloride, a second layer of pure sodium chloride and a third layer af polyethylene glycol.

The product is stable and non-hygroscopic for a prolonged period of time in an atmosphere with a high moisture content.

Example 8

1000 litre ocean water containing 3,7 % mineral salts is evaporated stepwise to a volume of 16 litre. About 25 kg sodium chloride is separated, leaving a mother liquid containing 1 g calcium carbonate, 37 g calcium sulfate, 1670 g sodium chloride, 455 g potassium chloride, 105 g sodium bromide, 3395 g magnesium chloride, 1995 g magnesium sulfate and 420 g different minerals salts, including the "essential" mineral salts.

The mother liquid is spray dried to form particles of 50-150 µm. This particulate product has a distinct bitter taste and is very hygroscopic.

The particulate product is coated with a 1 % solution of sodium alginate using a conventional fluid bed coating apparatus. Each particle is thus coated with a thin layer of sodium alginate which is converted to insoluble calcium alginate due to the content of calcium salts in the mother

liquid.

The coated particles are then coated with a concentrated solution of sodium chloride, using the same fluid bed coating apparatus as mentioned above. The amount of coating solution is chosen to obtain 200 g sodium chloride in the surface layer for each 100 g core material.

The product is free flowing non-hygroscopic and has the same taste as pure sodium chloride, without any bitter after taste.

PATENT CLAIMS

1. A particulate mineral salt composition, comprising particles containing sodium chloride, potassium chloride, magnesium salts and a broad spectrum of other mineral salts, including trace elements, in physiologically acctptable amounts and proportions, wherein each or a major part of said particles consists of a core having one or more coatings, the magnesium salts and trace elements being primarily concentrated in the core and at least one of the coatings has a high content of sodium chloride or consists of a mixture of sodium chloride and potassium chloride, preferably devoid of magnesium salts.

2. A mineral salt composition acording to any of the preceding claims, wherin the particles has a substantially spherical form and a diameter of 50 - 1000 μm, preferably 100 - 500 μm and more preferably 150 - 300 μm.

3. A mineral salt composition according to claim 1 or 2, characterized in that the core has substantially the same content of mineral salts as in ocean water.

4. A mineral salt composition according to claim 1 or 2, characterized in that the core has substantially the same content of mineral salts as in ocean water, except for a decreased content of sodium chloride and an increased content of potassium chloride.

5. A mineral salt composition according to claim 1, characterized in that at least one coating or surface layer consists of pure sodium chloride.

6. A mineral salt composition according to claim 1 or 2, characterized in that at least one coating or surface layer consists of a mixture of sodium chloride and potassium chloride.

7. A mineral salt composition according to claim 1 or 2, characterized in that each or a substantial part of the particles has an outer coating or suface layer consisting of or containing a non-hygroscopic or water repellent substance, such as sodium alginate, polyethylene glycol, carboxymethylcellulose, methylcellulose, or similar.

8. A mineral salt composition according to claim 1 or 2, characterized in that at least one coating or surface layer further comprises one or more of such additives as anti-hygroscopic agents, water repellant agents, flavouring agents, spices, or similar.

8. A mineral salt composition according to claim 1 or 2, characterized in that each or a substantial part of the particles has an outer coating or surface layer consisting of a water repellent or non-hygroscopic substance, such as sodium alginate, polyethylene glycol, carboxymethylcellulose, methylcellulose and similar.

9. A mineral salt composition, comprising particles having a core and at least one coating or surface layer, the composition of the core being 35-65 % sodium chloride, 5-40 % potassium chloride, 5-35 % magnesium salts and if desired also 0,01-1 % essential trace metal salts, and the composition of at least one coating or surface layer being 35-100 % sodium chloride and 65-0 % potassium chloride.

10. A process for producing the mineral salt composition as defined in any of the claims 1-9, wherein a first solution containing sodium chloride, potassium chloride, magnesium salts and a broad spectrum of other mineral salts, including trace elements, in physiologically acceptable amounts and proportions, is spray dried, whereafter the particles obtained are coated, in a manner known per se, with a second solution containing sodium chloride or a mixture of sodium chloride and potassium chloride.

11. A process according to claim 10, characterized in that the particles are further coated with a physiologically acceptable water repellent substance, such as sodium alginate, polyethylene glycol, carboxymethylcellulose, methylcellulose or similar.

12. A table salt having the composition and the properties as indicated in any of the claims 1 - 9.

AMENDED CLAIMS

[received by the International Bureau on 13 August 1992 (13.08.92); original claims 1-12 replaced by amended claims 1-7 (2 pages)]

1. A particulate mineral salt composition, comprising particles consisting of a core and one or more coatings, *characterized* in that the core has substantially the same content of mineral salts as in ocean water, except for a decreased content of sodium chloride, and that the coating or at least one of the coatings has a high content of sodium chloride, substantially devoid of other mineral components, and that the ratio between the sum of the amount of sodium chloride in the core and the amount of sodium chloride in the coating(s) on one side and the amount of other mineral components in the core on the other the side is approximately the same as the corresponding ratio between the amount of sodium chloride and the amount of other mineral salts in ocean water.

2. A mineral salt composition according to claim 1, *characterized* in that the particle size is 50-1000 µm, preferably 100-500 µm and more preferably 150-300 µm.

3. A mineral salt composition according to claim 1 or 2, *characterized* in that the core has a coherent coating or surface layer of a non-hygroscopic or water repellant substance, and that the surface of this layer is coated with sodium chloride in microcrystalline form.

4. A mineral salt composition according to claim 3, *characterized* in that the non-hygroscopic or water repellant substance is sodium alginate, polyethylene glycol, carboxymethyl cellulose or methylcellulose.

5. A process for producing the mineral salt composition as defined in any of claims 1 - 4, *characterized* in that ocean water, in a first step, is evaporated until a

substandtial part of the sodium chloride in the water is separated by fractional crystallization, that the residual concentrated liquid, in a second step, is spray dried to produce core particles, and that the dry particles thus produced, in a third step, is coated with pure sodium chloride in such an amount that the ratio between the total content of sodium chloride and the content of other mineral salts in each particle is approximately the same as in ocean water.

6. A process according to claim 5, *characterized* in that the core particles produced in the second step is coated with a coherent non-hygroscopic or water repellant substance in an intermediate step before the coating in the third step is performed.

7. A table salt having the composition and the properties as indicated in any of the claims 1 - 4 or produced in the process of claim 5 or 6.

INTERNATIONAL SEARCH REPORT

International Application No PCT/DK 92/00076

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[5]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: A 23 L 1/237

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	A 23 L

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in Fields Searched[8]

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
Y	WO, A1, 8605954 (SUNPOL CONSULT APS) 23 October 1986, see claims 1-2,7-9 --	1,4-6, 10
Y	WO, A1, 9000522 (AB HANSON & MÖHRING) 25 January 1990, see claims 8-9 --	1,4-6, 10
Y	Patent Abstracts of Japan, Vol 8, No 273, C256, abstract of JP 59-146564, publ 1984-08-22 (FUNDOOKIN SHIYOUYU K.K.) --	1,4-6, 10

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* Special categories of cited documents: [10]

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"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
11th June 1992	1992 -06- 17
International Searching Authority	**Signature of Authorized Officer**
SWEDISH PATENT OFFICE	Inga-Karin Petersson Inga-Karin Petersson

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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. PCT/DK 92/00076

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the Swedish Patent Office EDP file on 30/04/92
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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
WO-A1- 8605954	86-10-23	AU-B-	601150	90-09-06
		AU-D-	5698486	86-11-05
		EP-A-B-	0221096	87-05-13
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		EP-A-	0441786	91-08-21
		JP-T-	3505969	91-12-26
		SE-B-	465669	91-10-14
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